CLAIMS

WHAT IS CLAIMED IS:

1. An apparatus for parallel processing of reaction mixtures comprising:

a reactor block including reaction chambers for containing reaction mixtures under pressure, the reactor block further including a first sidewall, a second sidewall, and a first plurality of fluid flow paths providing fluid communication with the first sidewall and respective reaction chambers and the second sidewall and respective reaction chambers;

a stirring system including a base plate defining a second plurality of flow paths, wherein respective flow paths of said second plurality of flow paths are in fluid communication with respective reaction chambers and respective fluid flow paths of said first plurality of flow paths, and said base plate supporting a plurality of stirring blade assemblies for mixing the reaction mixtures, wherein one stirring blade assembly of said plurality of stirring blade assemblies is received in the respective reaction chambers; and

interchangeable manifolds supported by the first sidewall and the second sidewall, the interchangeable manifolds defining a plurality of manifold inlet/outlet ports, wherein respective inlet/outlet ports of said plurality of inlet/outlet ports are in communication with respective fluid flow paths of said first plurality of fluid flow paths and permit fluid to be introduced into or vented from the respective reaction chambers.

2. The apparatus of claim 1, wherein a group of four fluid flow paths of the first plurality of fluid flow paths are in fluid communication with respective reaction chambers.

3. The apparatus of claim 2, wherein two of the four fluid flow paths are defined by the first sidewall and two of the four fluid flow paths are defined by the second sidewall.

4. The apparatus of claim 3, wherein one of the two fluid flow paths defined by the first sidewall is in fluid communication with the respective reaction chamber via one flow path of said second plurality of flow paths, and one of the two fluid flow paths defined by the second sidewall is in fluid communication with the respective reaction chamber via one flow path of said second plurality of flow paths.

5. The apparatus of claim 3, wherein one of the two fluid flow paths defined by the first sidewall is in fluid communication with a head space defined by the respective reaction chambers above the reaction mixture via one flow path of said first plurality of fluid flow paths, and one of the two fluid flow paths defined by the second sidewall is in fluid communication with the head space of the respective reaction chamber via one flow path of said first plurality of fluid flow paths.

6. The apparatus of claim 1, wherein the respective reactor chambers define a reactor well having an open center.

7. The apparatus of claim 6, wherein the open center of each reactor well receives a vessel for retaining the reaction mixture.

8. The apparatus of claim 7, wherein the vessels are removable liners, each liner having an interior surface defining a cavity for containing one of the reaction mixtures and an exterior surface dimensioned so that the liners fit within one reactor well.

9. The apparatus of claim 6, wherein the removable liners are glass or plastic vials.

10. The apparatus of claim 1, wherein the plurality of inlet/outlet ports of the interchangeable manifolds define separate flow paths through the respective interchangeable manifold bars.

11. The apparatus of claim 10, wherein a first group of inlet/outlet ports of said plurality of inlet/outlet ports includes inlet/outlet ports in fluid communication with respective flow paths of said first plurality of flow paths and respective flow paths of said second plurality of flow paths, wherein each inlet/outlet port of said first group is in fluid communication with respective flow paths of said first plurality of fluid flow paths and respective flow paths of said second plurality of fluid flow paths.

12. The apparatus of claim 1, wherein a second group of inlet/outlet ports selected from said plurality of inlet/outlet ports are in fluid communication with respective flow paths of said first plurality of fluid flow paths, wherein the respective flow paths of said first plurality of fluid flow paths is in fluid communication with a head space defined within the respective reaction chambers, wherein each inlet/outlet port of said second group is in fluid communication with a respective flow path of said first plurality of fluid flow paths.

13. The apparatus of claim 12, wherein a third group of inlet/outlet ports selected from said plurality of inlet/outlet ports is in fluid communication with a source of fluid to be introduced into the respective reaction chambers, wherein each inlet/outlet port of said third group establishes separate fluid flow paths with a respective flow path of said first plurality of fluid flow paths.

14. The apparatus of claim 13, wherein a fourth group of inlet/outlet ports selected from said plurality of inlet/outlet ports is vented to the head space, wherein each inlet/outlet port of said fourth group establishes separate fluid flow paths with a respective flow path of said first plurality of fluid flow paths.

15. The apparatus of claim 1, wherein the interchangeable manifolds include a manifold bar wherein a fifth group of inlet/outlet ports selected from said plurality of inlet/outlet ports are coupled in fluid communication so as to define a common flow path through the fifth group, wherein each inlet/outlet port of said fifth group is in fluid communication with separate flow paths forming said first plurality of fluid flow paths.

16. The apparatus of claim 15, wherein said fifth group is coupled to a common fluid source so as to form a common flow path therethrough.

17. The apparatus of claim 16, wherein each inlet/outlet port comprising the fifth group of inlet/outlet ports is in fluid communication with the respective reaction chambers.

18. The apparatus of claim 15, wherein the fifth group of inlet/outlet ports is coupled to a common pressure source so as to form a common flow path therethrough.

19. The apparatus of claim 18, wherein each inlet/outlet port of the fifth group of inlet/outlet ports is vented to a head space defined by the respective reaction chambers.

20. The apparatus of claim 10, 16, or 18, wherein one of said interchangeable manifold bars is supported by the first sidewall and the second sidewall respectively.

21. The apparatus of claim 1, wherein each stirring blade assembly includes:

a spindle, each spindle having a first end and a second end; and
a stirring blade attached to the first end of the spindle.

22. The apparatus of claim 21, wherein the second end of the spindle is mechanically coupled to a drive mechanism.

23. The apparatus of claim 22, wherein the drive mechanism is a motor driven gear drive system.

24. The apparatus of claim 23, further including a motor speed control electrically coupled to the motor for controlling or monitoring the rotational speed of the motor.

25. The apparatus of claim 23, wherein the drive mechanism is enclosed by a cover.

26. The apparatus of 25, wherein the cover is metal.

27. The apparatus of claim 1, wherein the stirring system base plate provides a sealing surface for isolating the reaction chambers from ambient conditions, and further permitting the application of a positive pressure to the respective reaction chambers, wherein the maximum pressure can reach 1500 psi.

28. The apparatus of claim 1, wherein the stirring system supports an injector system for introducing additional chemistry into the respective reaction chambers under pressure, the injector system including an injector manifold bar defining a plurality of injector manifold inlet/outlet ports for receiving a vessel coupling the injector manifold bar to a source of injection fluid, wherein separate injector manifold inlet/outlet ports forming said plurality of injector inlet/outlet ports is in fluid communication with the respective reaction chambers.

29. The apparatus of claim 28 further including a third plurality of flow paths defined by the injector manifold bar, wherein separate flow paths of

said third plurality flow paths are in fluid communication with the respective reaction chambers via one flow path of a fourth plurality of flow paths defined by the base plate.

30. The apparatus of claim 29, wherein the respective flow paths comprising the fourth plurality of flow paths are separately coupled in fluid communication with a delivery tube, wherein separate delivery tubes are in fluid communication with each of the respective chambers.

31. The apparatus of claim 28, wherein the injector system further includes separate fill ports received in the respective injector manifold inlet/outlet ports and a separate fluid delivery probe supported by the respective fill ports, wherein each delivery probe is in fluid communication with chemistry or other components to be injected into the respective reaction chambers.

32. The apparatus of claim 31, wherein the respective fill ports include an elongated body having a longitudinal axis and a bore centered on the longitudinal axis, the bore extending the length of the elongated body.

33. The apparatus of claim 32 further including a fitting received with the bore of the respective fill ports for supporting the delivery probe.

34. The apparatus of claim 33, wherein the fitting is made of a chemically resistant plastic material.

35. The apparatus of claim 1, including a sampling manifold assembly coupled in fluid communication with the respective reaction chambers via at least one of the interchangeable manifolds, wherein a portion of the reaction mixture retained in the respective reaction chambers can be withdrawn from the respective reaction chamber through respective fluid flow paths of said first plurality of fluid flow paths, respective flow paths of said

second plurality of flow paths, or both, without depressurizing or lowering the pressure in the respective reaction chambers.

36. The apparatus of claim 35, wherein the sampling manifold assembly includes:

first flow control valves having an inlet port and an outlet port, wherein separate flow control valves are in fluid communication with one of the respective reaction chambers;

second flow control valves, wherein each respective second flow control valve includes one inlet port, one inlet/outlet port and one outlet port, wherein separate inlet ports are in fluid communication with separate valves of said first flow control valves; and

third flow control valves, wherein each respective third flow control includes one inlet port and one outlet port, wherein separate inlet ports are in fluid communication with separate second flow control valves and separate outlet ports are in fluid communication with a pressure source.

37. The apparatus of claim 35, wherein the first flow control valves include:

a first tubular member having a first end coupled to the inlet port defined by the first flow control valve and a second end in fluid communication with one of the respective reaction chambers, and

a second tubular member having one end supported by the outlet port of the first flow control valve and a second end coupled to the first inlet port of one value of said second flow control valves.

38. The apparatus of claim 37, wherein the second end of separate first tubular members are in fluid communication with a dip tube selected from a plurality of dip tubes, each dip tube having one end supported by a portion of the stirring system so as to establish fluid communication between one dip tube and one flow path of said second plurality of flow paths and an opposite

end that extends at least partially into one of the respective reaction chambers.

39. The apparatus of claim 38, wherein the respective dip tubes are hollow tubular members.

40. The apparatus of claim 39, wherein the dip tubes can be glass or plastic vials or liners or Teflon® tubes.

41. The apparatus of claim 37, wherein the separate inlet/outlet ports of the respective second flow control valves supports a third tubular member, wherein one end of the third tubular member is supported by the inlet/outlet port of the respective second flow control valves and an opposite end of the third tubular member is supported by the outlet port of the third flow control valves, and the outlet ports of the respective second flow control valves support a fourth tubular member having one end coupled to the outlet port of one of the respective second flow control valves and a second end in fluid communication with a sample vial.

42. The apparatus of claim 41, wherein the inlet ports of the respective third flow control valves support a fifth tubular member coupled to a pressure source, and the third flow control valves include further an outlet port in fluid communication with the inlet/outlet port of the second flow control valve.

43. The apparatus of claim 1, further including temperature control systems for maintaining the reaction mixture contained in the respective reaction chambers at a desired temperature.

44. The apparatus of claim 43, wherein the respective temperature control systems include:

one or more heating devices in thermal contact with respective reaction chambers, wherein the respective reaction chambers can be heated to the same or different temperatures; and

temperature sensors in thermal contact with the respective reaction chambers for measuring the temperature of the respective reaction mixture, the respective reaction chamber or both.

45. The apparatus of claim 44, wherein the temperature sensors are thermocouples.

46. The apparatus of claim 44, wherein the respective temperature control systems further include a microprocessor for monitoring or adjusting the temperature of the heating device.

47. The apparatus of claim 46, wherein the respective microprocessor is electrically coupled to a solid state relay for controlling power to the respective heating devices, wherein the solid state relay can be caused to become active if the respective microprocessor senses a temperature in the respective reaction chamber above or below a preselected or desired value.

48. The apparatus of claim 43, wherein the temperature control systems further include separate display screens for displaying the temperature of the respective reaction chambers or information determinative of the temperature of the respective reaction chamber.

49. The apparatus of claim 48, wherein the respective display screens support a selectively adjustable temperature control switch for varying the temperature of the respective heating devices.

50. The apparatus of claim 1, wherein the reaction chambers are continuous or semi-continuous flow reaction chambers.

51. The apparatus of claim 1 further including a filter for filtering the fluid introduced into, withdrawn or vented from, the respective reaction chambers.

52. An apparatus for parallel processing of reaction mixtures comprising:

a reactor block including reaction chambers for containing reaction mixtures under pressure, the reactor block further including a first sidewall, a second sidewall, and a first plurality of fluid flow paths providing fluid communication with the first sidewall and respective reaction chambers and the second sidewall and respective reaction chambers;

a stirring system including a base plate defining a second plurality of flow paths, wherein respective flow paths of said second plurality of flow paths are in fluid communication with respective reaction chambers and respective fluid flow paths of said first plurality of flow paths, and said base plate supporting a plurality of stirring blade assemblies for mixing the reaction mixtures, wherein one stirring blade assembly of said plurality of stirring blade assemblies is received in the respective reaction chambers;

at least one interchangeable manifold supported by the first sidewall, the interchangeable manifold defining a plurality of manifold inlet/outlet ports, wherein respective inlet/outlet ports of said plurality of inlet/outlet ports are in communication with respective fluid flow paths of said first plurality of fluid flow paths; and

a sampling manifold assembly supported by the second sidewall in fluid communication with the respective reaction chambers through respective flow paths of the first plurality of flow paths, the second plurality of flow paths or both, wherein a portion of the mixtures can be withdrawn from the respective reaction chambers without depressurizing or lowering the pressure in the respective reaction chambers.

53. The apparatus of claim 52, wherein the sampling manifold assembly includes:

first flow control valves having an inlet port and an outlet port, wherein separate flow control valves are in fluid communication with one of the respective reaction chambers;

second flow control valves, wherein each respective second flow control valve includes one inlet port, one inlet/outlet port and one outlet port, wherein separate inlet ports are in fluid communication with separate valves of said first flow control valves; and

third flow control valves, wherein each respective third flow control includes one inlet port and one outlet port, wherein separate inlet ports are in fluid communication with separate second flow control valves and separate outlet ports are in fluid communication with a pressure source.

54. The apparatus of claim 52, wherein the first flow control valves include:

a first tubular member having a first end coupled to the inlet port defined by the first flow control valve and a second end in fluid communication with one of the respective reaction chambers, and

a second tubular member having one end supported by the outlet port of the first flow control valve and a second end coupled to the first inlet port of one value of said second flow control valves.

55. The apparatus of claim 54, wherein the second end of separate first tubular members are in fluid communication with a dip tube selected from a plurality of dip tubes, each dip tube having one end supported by a portion of the stirring system so as to establish fluid communication between one dip tube and one flow path of said second plurality of flow paths and an opposite end that extends at least partially into one of the respective reaction chambers.

56. The apparatus of claim 55, wherein the respective dip tubes are hollow tubular members.

57. The apparatus of claim 56, wherein the dip tubes can be glass or plastic vials or liners or Teflon® tubes.

58. The apparatus of claim 54, wherein the separate inlet/outlet ports of the respective second flow control valves supports a third tubular member, wherein one end of the third tubular member is supported by the inlet/outlet port of the respective second flow control valves and an opposite end of the third tubular member is supported by the outlet port of the third flow control valves, and the outlet ports of the respective second flow control valves support a fourth tubular member having one end coupled to the outlet port of one of the respective second flow control valves and a second end in fluid communication with a sample vial.

59. The apparatus of claim 58, wherein the inlet ports of the respective third flow control valves support a fifth tubular member coupled to a pressure source, and the third flow control valves include further an outlet port in fluid communication with the inlet/outlet port of the second flow control valve.

60. An apparatus for parallel processing of reaction mixtures comprising:

a reactor block including reaction chambers for containing reaction mixtures under pressure, the reactor block further including a first sidewall, a second sidewall, and a first plurality of fluid flow paths providing fluid communication with the first sidewall and respective reaction chambers and the second sidewall and respective reaction chambers;

a stirring system including a base plate defining a second plurality of flow paths, wherein at least respective flow paths of said second plurality of flow paths are in fluid communication with respective reaction chambers,

respective fluid flow paths of said first plurality of flow paths or both, and said base plate supporting a plurality of stirring blade assemblies for mixing the reaction mixtures, wherein one stirring blade assembly of said plurality of stirring blade assemblies is received in one of the respective reaction chambers, and said base plate further providing a sealing surface for isolating the reaction chambers from ambient conditions, and further permitting applying a positive pressure to the respective reaction chambers, wherein the maximum pressure can reach 1500 psi;

interchangeable manifolds supported by the first sidewall and the second sidewall for allowing the introduction of a fluid into or withdrawing a fluid from the respective reaction chambers, wherein said introduction or withdrawal of fluid occurs under pressure and without depressurizing or reducing the pressure of the respective reaction chambers, the interchangeable manifolds also defining a plurality of manifold inlet/outlet ports, wherein respective inlet/outlet ports of said plurality of inlet/outlet ports are in communication with respective fluid flow paths of said first plurality of fluid flow paths; and

a sampling manifold assembly coupled in fluid communication with the interchangeable manifolds, wherein a portion of the reaction mixture retained in the respective reaction chambers can be withdrawn from the respective reaction chambers through respective fluid flow paths of said first plurality of fluid flow paths and respective flow paths of said second plurality of flow paths, or both, without depressurizing the respective reaction chamber.

61. The apparatus of claim 60, wherein a group of four fluid flow paths of the first plurality of fluid flow paths are in fluid communication with respective reaction chambers.

62. The apparatus of claim 61, wherein two of the four fluid flow paths are defined by the first sidewall and two of the four fluid flow paths are defined by the second sidewall.

63. The apparatus of claim 62, wherein one of the two fluid flow paths defined by the first sidewall is in fluid communication with one reaction chamber of the respective reaction chambers via one flow path of said second plurality of flow paths, and one of the two fluid flow paths defined by the second sidewall is in fluid communication with one reaction chamber of the respective reaction chambers via one flow path of said second plurality of flow paths.

64. The apparatus of claim 62, wherein one of the two fluid flow paths defined by the first sidewall is in fluid communication with a head space defined by one reaction chamber of the respective reaction chambers above the reaction mixture via one flow path of said first plurality of fluid flow paths, and one of the two fluid flow paths defined by the second sidewall is in fluid communication with the head space of one reaction chamber of the respective reaction chamber via one flow path of said first plurality of fluid flow paths.

65. The apparatus of claim 60, wherein the respective reactor chambers define a reactor well having an open center.

66. The apparatus of claim 65, wherein the open center of each reactor well receives a vessel for retaining the reaction mixture.

67. The apparatus of claim 66, wherein the vessels are removable liners, each liner having an interior surface defining a cavity for containing one of the reaction mixtures and an exterior surface dimensioned so that the liners fit within one reactor well.

68. The apparatus of claim 65, wherein the removable liners are glass or plastic vials.

69. The apparatus of claim 60, wherein the plurality of inlet/outlet ports of the interchangeable manifolds define separate flow paths through the respective interchangeable manifold bars.

70. The apparatus of claim 69, wherein a first group of inlet/outlet ports of said plurality of inlet/outlet ports having inlet/outlet ports in fluid communication with respective flow paths of said first plurality of flow paths and respective flow paths of said second plurality of flow paths, wherein each inlet/outlet port of said first group establishes separate fluid flow paths with a respective flow path of said plurality of fluid flow paths.

71. The apparatus of claim 70, wherein a second group of inlet/outlet ports selected from said plurality of inlet/outlet ports include inlet/outlet ports in fluid communication with respective flow paths of said first plurality of fluid flow paths, wherein respective flow paths of said first plurality of fluid flow paths are in fluid communication with a head space defined within the respective reaction chambers, wherein respective inlet/outlet ports of said second group are in fluid communication with respective flow paths of said first plurality of fluid flow paths.

72. The apparatus of claim 71, wherein a third group of inlet/outlet ports selected from said plurality of inlet/outlet ports includes inlet/outlet ports in fluid communication with a source of fluid to be introduced into the respective reaction chambers, wherein each inlet/outlet port of said third group establishes fluid flow paths with one flow path of said first plurality of fluid flow paths.

73. The apparatus of claim 72, wherein a fourth group of inlet/outlet ports selected from said plurality of inlet/outlet ports is vented to the head space, wherein each inlet/outlet port of said fourth group is in fluid communication with respective fluid flow paths of said first plurality of fluid flow paths.

74. The apparatus of claim 73, wherein the interchangeable manifolds include a manifold bar wherein a fifth group of inlet/outlet ports selected from said plurality of inlet/outlet ports is coupled in fluid communication so as to define a common flow path through each inlet/outlet port of said fifth group, wherein each inlet/outlet port of said fifth group establishes fluid flow paths with respective flow paths of said first plurality of fluid flow paths.

75. The apparatus of claim 74, wherein said fifth group is coupled to a common fluid source so as to form a common flow path therethrough.

76. The apparatus of claim 75, wherein each inlet/outlet port comprising the fifth selected group of inlet/outlet ports is in fluid communication with the respective reactor wells.

77. The apparatus of claim 74, wherein each inlet/outlet port of the fifth selected group of inlet/outlet ports is coupled to a common pressure source so as to form a common flow path therethrough.

78. The apparatus of claim 77, wherein each inlet/outlet port of the fifth selected group of inlet/outlet ports is vented to a head space defined by the respective chambers.

79. The apparatus of claim 69, 75, or 77, wherein one of said interchangeable manifold bars is supported by the first sidewall and the second sidewall respectively.

80. The apparatus of claim 60, wherein each stirring blade assembly includes:

a spindle, each spindle having a first end and a second end; and
a stirring blade attached to the first end of the spindle.

81. The apparatus of claim 80, wherein the second end of the spindle is mechanically coupled to a drive mechanism.

82. The apparatus of claim 81, wherein the drive mechanism is a motor driven gear drive system.

83. The apparatus of claim 82, further including a motor speed control electrically coupled to the motor for controlling or monitoring the rotational speed of the motor.

84. The apparatus of claim 82, wherein the drive mechanism is enclosed by a cover.

85. The apparatus of 84, wherein the cover is metal.

86. The apparatus of claim 60, wherein the stirring system supports an injector system for introducing additional chemistry into the respective reaction chambers under pressure, the injector system including an injector manifold bar defining a plurality of injector manifold inlet/outlet ports for receiving a vessel coupling the injector manifold bar to a source of injection fluid, wherein separate injector manifold inlet/outlet ports forming said plurality of injector inlet/outlet ports is in fluid communication with the respective reaction chambers.

87. The apparatus of claim 60 further including a third plurality of flow paths defined by the injector manifold bar, wherein separate flow paths of said third plurality flow paths are in fluid communication with the respective reaction chambers via one flow path of a fourth plurality of flow paths defined by the base plate.

88. The apparatus of claim 87, wherein the respective flow paths comprising the fourth plurality of flow paths are separately coupled in fluid communication with a delivery tube, wherein separate delivery tubes are in fluid communication with each of the respective chambers.

89. The apparatus of claim 87, wherein the injector system further includes separate fill ports received in the respective injector manifold inlet/outlet ports and a separate fluid delivery probe supported by the respective fill ports, wherein each delivery probe is in fluid communication with chemistry or other components to be injected into the respective reaction chambers.

90. The apparatus of claim 89, wherein the respective fill ports include an elongated body having a longitudinal axis and a bore centered on the longitudinal axis, the bore extending the length of the elongated body.

91. The apparatus of claim 90 further including a fitting received with the bore of the respective fill ports for supporting the delivery probe.

92. The apparatus of claim 92, wherein the fitting is made of a chemically resistant plastic material.

93. The apparatus of claim 60, wherein the sampling manifold assembly includes:

first flow control valves having an inlet port and an outlet port, wherein separate flow control valves are in fluid communication with one of the respective reaction chambers;

second flow control valves, wherein each respective second flow control valve includes one inlet port, one inlet/outlet port and one outlet port, wherein separate inlet ports are in fluid communication with separate valves of said first flow control valves; and

third flow control valves, wherein each respective third flow control includes one inlet port and one outlet port, wherein separate inlet ports are in fluid communication with separate second flow control valves and separate outlet ports are in fluid communication with a pressure source.

94. The apparatus of claim 93, wherein the first flow control valves include:

a first tubular member having a first end coupled to the inlet port defined by the first flow control valve and a second end in fluid communication with one of the respective reaction chambers, and

a second tubular member having one end supported by the outlet port of the first flow control valve and a second end coupled to the first inlet port of one value of said second flow control valves.

95. The apparatus of claim 94, wherein the second end of separate first tubular members are in fluid communication with a dip tube selected from a plurality of dip tubes, each dip tube having one end supported by a portion of the stirring system so as to establish fluid communication between one dip tube and one flow path of said second plurality of flow paths and an opposite end that extends at least partially into one of the respective reaction chambers.

96. The apparatus of claim 95, wherein the respective dip tubes are hollow tubular members.

97. The apparatus of claim 96, wherein the dip tubes can be glass or plastic vials or liners or Teflon® tubes.

98. The apparatus of claim 95, wherein the separate inlet/outlet ports of the respective second flow control valves supports a third tubular member, wherein one end of the third tubular member is supported by the inlet/outlet port of the respective second flow control valves and an opposite

end of the third tubular member is supported by the outlet port of the third flow control valves, and the outlet ports of the respective second flow control valves support a fourth tubular member having one end coupled to the outlet port of one of the respective second flow control valves and a second end in fluid communication with a sample vial.

99. The apparatus of claim 98, wherein the inlet ports of the respective third flow control valves support a fifth tubular member coupled to a pressure source, and the third flow control valves include further an outlet port in fluid communication with the inlet/outlet port of the second flow control valve.

100. The apparatus of claim 50, further including temperature control systems for maintaining the reaction mixture contained in the respective reaction chambers at a desired temperature.

101. The apparatus of claim 100, wherein the respective temperature control systems include:

one or more heating devices in thermal contact with respective reaction chambers, wherein the respective reaction chambers can be heated to the same or different temperatures; and

temperature sensors in thermal contact with the respective reaction chambers for measuring the temperature of the respective reaction mixture, the respective reaction chamber or both.

102. The apparatus of claim 101, wherein the temperature sensors are thermocouples.

103. The apparatus of claim 102, wherein the respective temperature control systems further include a microprocessor for monitoring and adjusting the temperature of the heating device.

104. The apparatus of claim 103, wherein the respective microprocessor is electrically coupled to a solid state relay for controlling power to the respective heating devices, wherein the solid state relay can be caused to become active if the respective microprocessor senses a temperature in the respective reaction chamber above or below a preselected or desired value.

105. The apparatus of claim 104, wherein the temperature control system further includes separate display screens for displaying the temperature of the respective reaction chambers or information determinative of the temperature of the respective reaction chamber.

106. The apparatus of claim 105, wherein the respective display screens support a selectively adjustable temperature control switch for varying the temperature of the respective heating devices.

107. The apparatus of claim 60, wherein the reaction chambers are continuous or semi-continuous flow reaction chambers.

108. The apparatus of claim 60 further including a filter for filtering the fluid introduced into, withdrawn or vented from, the respective reaction chambers.

109. A method of parallel processing multiple reaction mixtures comprising the steps of:

providing reaction chambers with starting materials to form reaction mixtures;

agitating the reaction mixtures during at least a portion of the experiment;

providing interchangeable manifolds having inlet/outlet ports in fluid communication with the respective reaction chambers, wherein a fluid can be

introduced into, withdrawn from or vented through the respective reaction chambers; and

evaluating one or more properties of the reaction mixtures or a portion of the reaction mixture by measuring at least one characteristic of the reaction mixtures during at least a portion of the reaction.

110. The method of claim 109, further including the step of sampling a portion of the reaction mixture from the respective reaction chambers via at least one of the interchangeable manifolds, wherein sampling occurs at a pressure greater than ambient conditions and without reducing the pressure in the respective reaction chambers.

111. The method of claim 109 further including the step of filtering fluid introduced into or withdrawn from the respective reaction chambers.

112. The method of claim 109 further including the step of applying a positive pressure to the respective reaction chambers, wherein the maximum pressure is 1500 psi.

113. The method of claim 109 further including the step of introducing a fluid into the respective reaction chambers under pressure.

114. The method of claim 113 further including the step of venting outlet ports associated with the respective reaction chambers to a head space defined by the reaction chambers.

115. The method of claim 113 further including the step of providing an inlet port in fluid communication with the respective reaction chambers so as to establish a common flow path to the respective reaction chambers.

116. The method of claim 115 further including the step of providing an outlet port in fluid communication with the respective reaction chambers so as to vent the respective reaction chambers to a head space defined by the respective reaction chambers or plugging said outlet port to prevent fluid flow therethrough.

117. The method of claim 115 further including the step of coupling the respective reaction chambers to a common pressure source so as to establish a common pressure across the respective reaction chambers.

118. The method of claim 117 further including the step of providing an outlet port in fluid communication with the respective reaction chambers so as to vent the respective reaction chambers to a head space defined by the respective reaction chambers or plugging said outlet port to prevent fluid flow therethrough.

119. The method of claim 109, wherein the reaction chambers are provided with starting materials using a robotic materials handling system.

120. The method of claim 119 further including the step of placing the reaction chambers in a sealed enclosure.

121. The method of claim 120 further including the step of blanketing the respective reaction chambers in an inert gas atmosphere while providing the respective reaction chambers with the starting materials.

122. The method of claim 109, wherein the reaction mixtures are evaluated by monitoring a temperature of each of the reaction mixtures.

123. The method of claim 109, wherein the reaction mixtures are evaluated by monitoring heat transfer rates into or out of the respective reaction chambers.

124. The method of claim 123, wherein monitoring the heat transfer rates comprises the steps of:

measuring temperature differences between each of the reaction mixtures and a thermal reservoir surrounding the reaction chambers; and

determining heat transfer rates from a calibration relating the temperature differences to heat transfer rates.

125. The method of claim 123 further comprising computing conversion of the starting materials based on the heat transfer rates of the monitoring step.

126. The method of claim 125, further comprising determining rates of reaction based on conversion of the starting materials.

127. The method of claim 109, wherein the agitating step can include the steps of:

bringing a stirring blade assembly into contact with the reaction mixtures, the stirring blade assembly including a spindle supporting a rotatable stirring blade; and

rotating each of the stirring blades so as to cause agitation or mixing of the reaction mixtures.

128. The method of claim 109, wherein the stirring blades rotate at the same rate, the stirring blades being driven by a motor driven gear drive system.

129. The method of claim 127, wherein the reaction mixtures are evaluated by monitoring the torque needed to rotate the stirring blade assembly.

130. The method of claim 129, wherein the torque is monitored by measuring the phase lag between the motor torque and the torque of the stirring blade assembly.

131. The method of claim 129, wherein the reaction mixtures are evaluated by determining the viscosity of each of the reaction mixtures from a calibration relating torque and viscosity.

132. The method of claim 131, wherein the reaction mixtures are evaluated by the steps of :

measuring the heat transfer rates into or out of the respective reaction chambers;

computing conversion of the starting materials based on heat transfer rates into or out of the respective reaction chambers; and

calculating molecular weight of a component of the reaction mixtures based on conversion of the starting materials and on viscosity of each of the reaction mixtures.

133. The method of claim 127, wherein the evaluating step further comprises the step of monitoring the power needed to rotate each of the stirring blade assemblies in the rotating step.

134. The method of claim 133, wherein the reaction mixtures are evaluated by determining the viscosity of each of the reaction mixtures from a calibration relating power and viscosity.

135. The method of claim 134, wherein the reaction mixtures are evaluated by the steps of:

measuring the heat transfer rates into or out of the respective reaction chambers;

computing the conversion of the starting materials based on heat transfer into or out of the reaction chambers; and

calculating the molecular weight of a component of the reaction mixtures based on conversion of the starting materials and the viscosity of each of the reaction mixtures.

136. The method of claim 109, wherein the property evaluated during the evaluation step includes molecular weight, specific gravity, elasticity, dielectric constant, conductivity or calorimetric data.

137. The method of claim 109, wherein the step of removing a portion of the reaction mixture from the respective reaction chambers includes the step of establishing a fluid flow path in fluid communication with the respective reaction chambers and ambient conditions, wherein a portion of the reaction mixture can be forced out of the respective reaction chambers and into a sample loop when the fluid flow path is exposed to ambient conditions.

138. The method of claim 137, wherein the step of removing a portion of the reaction mixture from the respective reaction chambers further includes the step of:

providing first flow control valves having an inlet port supporting a first tubular member, the first tubular member having one end in fluid communication with the respective reaction chambers and a second end supported by the first flow control valve such that the second end can be exposed to ambient conditions, whereby the back pressure in the respective reaction chambers pushes a portion of the reaction mixture into the first tubular member when the second end of the tubular member is exposed to ambient conditions.

139. The method of claim 138, further including the step of:

providing a second tubular member having one end in fluid communication with the first flow control valve and a second end in fluid communication with a selectively openable and closeable inlet port of a second flow control valve, wherein the portion of the reaction mixture drawn

into the first tubular member can flow through the second tubular member, through the second flow control valve via an inlet/outlet port of the second flow control valve and into the sample loop, said sample loop having one end supported by the inlet/outlet port and an opposite end supported by a third flow control valve.

140. The method of claim 139, further including the step of:
providing a fourth tubular member in fluid communication with the second flow control valve and a sample vial, the fourth tubular member having a first end in fluid communication with a selectively openable and closeable outlet port defined by the second flow control valve and a second end in fluid communication with the sample vial, wherein the portion of the reaction mixture drawn into the sample loop can flow back through the second flow control, through the fourth tubular member and into the sample vial when the outlet port of the second flow control valve is opened.

141. The method of claim 140, further including the steps of:
providing a fifth tubular member having one end in fluid communication with a selectively openable and closeable inlet port defined by the third flow control valve and a second end in fluid communication with a supply of pressurized fluid, wherein the pressurized fluid can be caused to flow through the third flow control valve, the second flow control valve, the sample loop and the fourth tubular member upon opening the inlet port of the third flow control valve, closing the inlet port of the second flow control valve and opening a flow path between the sample loop and the sample vial and opening the second inlet port of the second flow control valve.

142. The method of claim 109, wherein the step of providing the reaction chamber with starting materials includes the step of providing starting materials in the form of a liquid, solid or a slurry.

143. The method of claim 109, wherein the step of providing the reaction chambers with starting materials can further include the step of adding a heterogeneous, homogeneous or asymmetric catalyst to the starting materials.

144. The method of claim 109, wherein the step of providing can include the step of providing the reaction chambers with starting materials includes the step of providing starting materials for conducting polymerization or hydrogenation reactions.